Environmental biotechnology and bioreactors					**Code of the course**		**Year / Semester**
Type of subject:		**Education Profile**		**The level of education**		**Form of studies**	
Obligatory		**General Academic**				**Stationary**	
Type of subject							**ECTS**
Lecture	**Exercises**	**Laboratory**	**Project**	**Seminar**	**Practical classes**	**Exam**	
15	**-**	**45**	**-**	**-**	**-**	**-**	**7**
Subject coordinator:							
Dr hab. Inż. Anna Grosser, prof. PCz., anna.grosser@pcz.pl							

II. COURSE CONTENT

Course type – Lecture		**Number of hours**
1	Introduction to environmental biotechnology	1
2	Fermentation in environmental biotechnology – microbial growth kinetics and yield constants; Monod kinetics; types of fermentation	1
3	Bioreactors - types, designs, and functional characteristics	1
4-5	Biomining	2
6	Agricultural biotechnology	1
7-8	Bioremediation of groundwater and contaminated soil	2
9-10	Biotechnology for waste and wastewater treatment	2
11-12	Biorefineries	2
13-14	Applications of biotechnology in environmental monitoring – bioindicators, biomarkers, biosensors	2

15	Test	1
	TOTAL:	**15**
Course type - Laboratory		**Number of hours**
	Wastewater treatment	10
	Evaluation of the degree of compost maturity on the basis of the germination index	4
	Energy recovery from waste	12
	Effect of lead and cadmium on morphological and physiological features of plants	4
	Bioremediation of contaminated soil	12
	Defense of studies	3
	TOTAL:	**45**

DIDACTIC METHODS	
1.	Blackboard, interactive whiteboard, e-learning platform
2.	Multimedia presentation
3.	Laboratory setup
4.	The literature and instructions for laboratory classes

METHODS OF ASSESSMENTS: (F – FORMATIVE; S – SUMMATIVE)	
F01	Activity in classes
F02	Evaluation of work during laboratory exercises
S01	Test
S02	Evaluation of the laboratory reports

III. STUDENT WORKLOAD		
L.p.	**Form of activity**	**Numer of hours for activity [hours]**
1. Direct teaching hours:		

1.1	Hours of classes organized by universities – lectures	15
1.2	Hours of classes organized by universities – exercises	
1.3	Hours of classes organized by universities – laboratory	45
1.4	Hours of classes organized by universities – project	
1.5	Hours of classes organized by universities – field activities	
1.6	Hours of classes organized by universities – seminar	
1.7	Exam	
	Total direct hours:	**60**
2. Student's own work		
2.1	Preparation for exercises and for final exams	
2.2	Preparation for laboratory test reports, preparation of individual	45
2.3	Preparing your own project	
2.4	Preparation for the final exam from the lecture	23
2.5	Exam Preparation	
2.6	Reading the literature	
	Total student's self-studies:	**68**
	Overall student workload:	**128**
TOTAL NUMBER OF ECTS FOR THE COURSE:		**7**
The number of ECTS credits that a student obtains in classes requiring the direct participation of the teacher:		**3,28**
The number of ECTS credits that the student obtains as part of his/her own work		**3,71**

IV. PRIMARY AND SUPPLEMENTARY LITERATURE

Primary literature

1	Scragg, A. H. (2005). Environmental biotechnology. New York: OXFORD university press.
2	Khan, F. A. (2020). Biotechnology fundamentals. CRC Press.
3	Vallero, D., Environmental Biotechnology: A Biosystems Approach (2010),
4	Sibi, G., (2023). Environmental Biotechnology Fundamentals to Modern Techniques, CRC Press
5	Bhat, R.A., (2022). Environmental Biotechnology, Apple Academic Press Inc.
6	Fulekar M. H., (2010). Environmental Biotechnology, CRC Press

7	Jördening, H-J., Winter J., (eds), (2005). Environmental Biotechnology: Concepts and Applications, Wiley-Blackwell
Supplementary literature	

VII. OTHER USEFUL INFORMATION ABOUT THE SUBJECT	
1.	Opportunity to review supporting materials and literature:
	Appropriate to the type of material - in teaching classes, in the TUC Central Library.
2.	Information on when and where the classes will be held
	Notice board at the Faculty of Infrastructure and Environment and on the website of the Faculty of Infrastructure and Environment, MSz USOS system.
3.	Information about the consultation (times + place):
	the staff consultation schedule is available on the Faculty of Infrastructure and Environment website and on the staff room door.